WHITEPAPER · VERSION 2.0

The Trust Layer for the Sustainable AI Economy

A green, EVM-compatible Layer-1 network uniting Proof of Staked Authority consensus, enterprise Blockchain-as-a-Service, native asset standards, EarthDAO governance, and AI-native trust infrastructure — powered by the EARTH utility currency.

“Build trust. Move value. Protect the future.”

LAYER-1 · EVM-COMPATIBLE · POSA CONSENSUS · GREEN VALIDATORS · BAAS · ESG-ALIGNED · AI-NATIVE

Prepared for developers, enterprises, governments, universities & institutional investors.

EARTH BLOCKCHAIN

PUBLIC WHITEPAPER · VERSION 2.0 · JULY 2026

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Abstract

Earth Blockchain is a sustainable, AI-native, EVM-compatible Layer-1 network engineered for enterprises, public institutions, and autonomous machine agents. This whitepaper specifies the protocol from first principles: an eight-layer architecture anchored by a Green Validator Network of low-power and renewable-powered nodes; a formally specified Proof of Staked Authority (PoSA) consensus mechanism with deterministic finality, reputation-weighted validator selection, and stake-based slashing; an execution and service layer that pairs a full EVM runtime with managed Blockchain-as-a-Service (BaaS) infrastructure; the Earth Blockchain Standards (EBS) — nine native, EVM-compatible asset and identity standards spanning fungible assets, NFTs, security assets, permissioned real-world assets, verifiable credentials, soulbound assets, semi-fungible assets, and token-bound accounts; EarthDAO on-chain governance; and an enterprise product suite comprising EarthDoc, EarthESG (with integrated carbon-credit infrastructure), EarthSCM, Earth RWA, and EarthAI.

The paper further defines the complete economic design of EARTH — the network’s native utility currency — at a fixed maximum supply of 90,000,000,000 units, including allocation, cliff-and-linear vesting, a decaying validator emission schedule, a self-balancing staking yield model, and a governable fee-burn counterbalance. It is intended as the authoritative technical and economic reference for the Earth Blockchain public launch, written for developers, enterprises, governments, universities, and institutional readers.

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1. Introduction

WEB3 · ENTERPRISE INFRASTRUCTURE · SUSTAINABLE BY DESIGN

Earth Blockchain is a sustainability-first, AI-native Layer-1 network built to make verification, value transfer, and machine-to-machine trust programmable at enterprise scale. Where much of the first two decades of blockchain innovation optimized for speculation, Earth Blockchain is engineered around a different thesis: the next wave of Web3 adoption will be driven by regulated enterprises, sustainability markets, and autonomous AI systems that need a shared, verifiable settlement layer — not a trading venue.

Three convictions shape the design. First, **trust must be verifiable by default**: every asset, transaction, credential, and autonomous agent on the network carries an auditable, tamper-evident history that counterparties and regulators can independently confirm. Second, **infrastructure must be sustainable in operation, not only in marketing**: consensus, validator hardware, and incentive design all treat energy efficiency as a protocol parameter. Third, **the network must serve machines as first-class economic actors**: autonomous AI agents require on-chain identity, provenance, and payment rails with the same rigor extended to human organizations.

Earth Blockchain is, in the strict sense, a deeptech undertaking: its differentiation rests on protocol engineering — consensus design, native standards, and machine-trust infrastructure — rather than on packaging existing components. This document is the authoritative reference for the Earth Blockchain public launch. It proceeds from first principles — problem, architecture, consensus, economic security, governance, interoperability, developer experience, applications, and currency economics — and specifies each with the precision expected of production Layer-1 documentation. Formal parameters that remain subject to EarthDAO ratification are explicitly marked as such.

1.1 Design Goals

Goal	Realization in the Protocol
Deterministic settlement	PoSA consensus with quorum attestation delivers non-probabilistic finality in seconds, suitable for enterprise reconciliation and machine payments (§6).
Low, predictable cost	A base-fee gas market with governable burn share keeps transaction costs stable for high-volume enterprise workloads (§7.2, §15.6).
Energy efficiency	Validation on single-board and solar-powered hardware; no proof-of-work computation anywhere in the protocol (§5, §13).
Developer familiarity	Full EVM equivalence, standard JSON-RPC, Solidity toolchain compatibility, and EBS standards that extend well-known ERC interfaces (§7, §8).
Enterprise operability	Managed BaaS endpoints, custodial and non-custodial wallets, and compliance-aware asset standards (EBS-1400 / EBS-3643) (§7.5, §8).
Credible neutrality	Open validator admission by stake and reputation, transparent on-chain governance, and a fixed 90B maximum currency supply (§6, §10, §15).

2. Vision & Mission

THE TRUST LAYER FOR THE SUSTAINABLE AI ECONOMY

"Build trust. Move value. Protect the future."

Vision. A global economy in which trust is shared infrastructure — where any document, asset, supply chain event, sustainability claim, or machine decision can be verified by anyone, instantly, without intermediaries, and without costing the planet.

Mission. To make trust a programmable public resource by uniting enterprise-grade blockchain infrastructure, sustainable validation, and AI-native trust services in one coherent Layer-1 network. Three design principles anchor every layer specified in this document:

Principle	Description
Verifiable by default	Every asset, transaction, and autonomous agent carries an auditable, tamper-evident history that enterprises and regulators can independently verify.
Efficient & sustainable at the core	Low-power PoSA consensus and accessible validator hardware make sustainability an operating parameter of the network, not a marketing claim.
Built for a machine economy	Native identity, provenance, and payment rails purpose-built for autonomous AI agents transacting alongside human organizations.

> **Sustainability commitment.** Earth Blockchain's validator specification favors renewable-powered, low-cost hardware — including Raspberry Pi–class devices and solar-powered nodes — over energy-intensive mining hardware, aligning network growth with green-technology principles rather than working against them (§5, §13).

3. The Problem: The Cost of Trust

WHY A TRUST LAYER, AND WHY NOW

Trust remains one of the most expensive and least efficient components of the global economy. Enterprises devote large recurring budgets to auditing, reconciliation, KYC, and fraud prevention. Document and credential fraud burdens institutions and governments. Cross-border settlement still traverses layered correspondent networks measured in days and percentage points. Supply-chain and asset-ownership records are fragmented across incompatible private databases — opaque, illiquid, and difficult to verify across jurisdictions. Each of these costs is, at root, the price of establishing that a record is authentic and that a counterparty will perform.

3.1 Why Existing Networks Fall Short for Enterprises

- **Volatile costs and probabilistic settlement.** Fee spikes and probabilistic finality complicate ERP integration, treasury operations, and service-level guarantees.
- **Energy and ESG exposure.** Proof-of-work energy profiles are incompatible with corporate sustainability mandates and disclosure regimes; even efficient networks rarely surface auditable sustainability data about their own operation.
- **Missing compliance primitives.** Permissionless standards alone cannot express transfer restrictions, investor eligibility, or credential semantics that regulated assets require; enterprises are left to build bespoke, non-interoperable extensions.
- **Governance uncertainty.** Unclear upgrade paths and off-chain decision-making create adoption risk for institutions with multi-year integration horizons.
- **No native seat for machines.** Autonomous AI agents are becoming economic actors — negotiating, purchasing, and executing — yet lack verifiable identity, auditable decision trails, and payment rails designed for machine-speed, machine-scale interaction.

3.2 The Opportunity

A sustainable, EVM-compatible, enterprise-grade Layer-1 that combines low-cost green validation, native compliance-aware asset standards, AI trust services, and ESG-aligned reporting tooling sits at the intersection of three converging markets: **enterprise Web3 infrastructure**, **sustainability and ESG technology**, and the **emerging machine economy**. Earth Blockchain addresses all three on one shared ledger, so that a carbon credit, a university degree, a tokenized invoice, and an AI agent's mandate are verified by the same consensus, priced in the same utility currency, and governed by the same transparent process.

> **Positioning.** Earth Blockchain does not compete to be the fastest venue for speculative exchange. It competes to be the most *verifiable, sustainable, and operable* settlement layer for institutions and intelligent machines — the categories of demand that compound over decades.

4. Protocol Architecture Overview

EIGHT LAYERS · ONE SHARED LEDGER OF TRUTH

Earth Blockchain is a single Layer-1 network whose protocol stack is organized as eight interlocking layers. To avoid confusion with the industry terms “Layer-1” and “Layer-2” (which denote whole networks), the internal layers are named by function rather than numbered. Value and trust flow upward from the physical validator network to the application ecosystem, while rewards and governance rights flow back down — keeping validators, developers, and enterprises aligned within a single closed-loop economy.

Fig. 1 — Earth Blockchain Protocol Stack

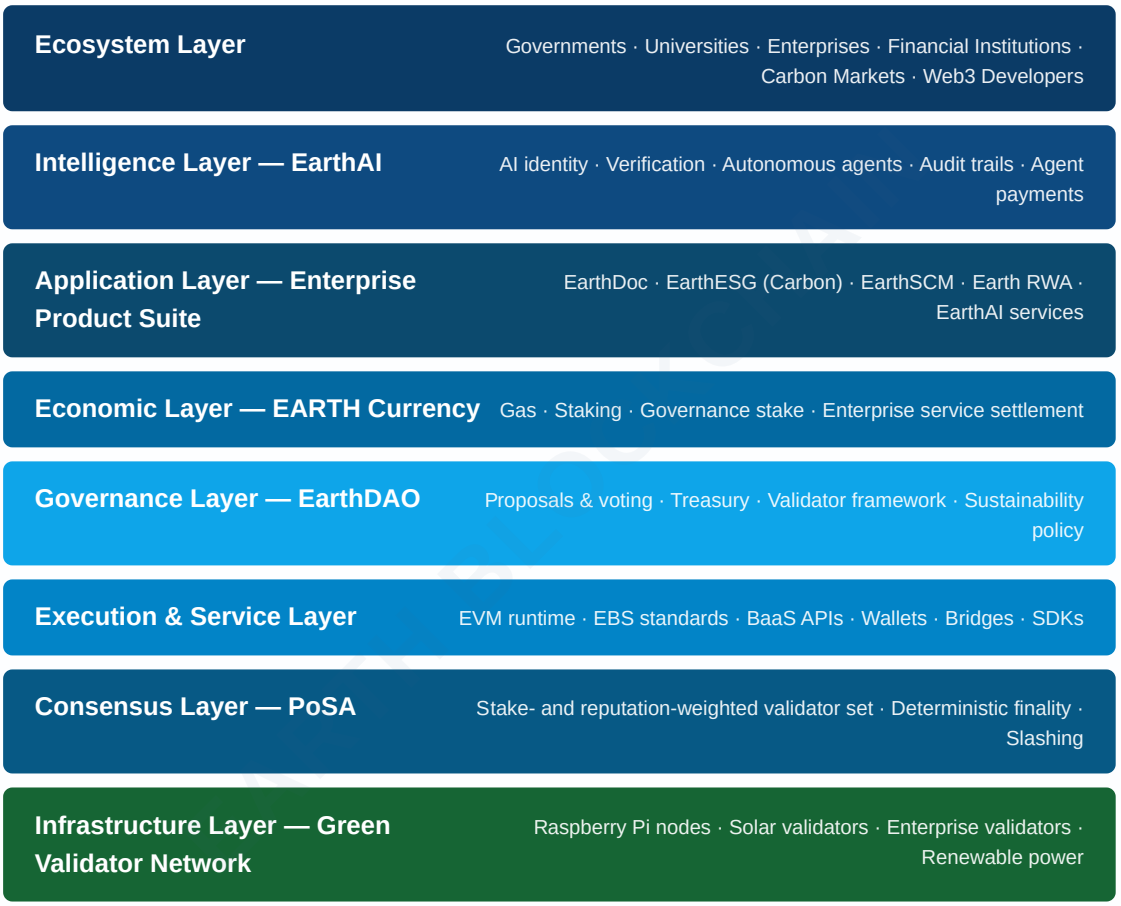


Fig. 1. The eight-layer protocol stack, from the Green Validator Network at the foundation to the ecosystem of participants at the top. Trust flows upward; rewards and governance rights flow downward.

4.1 Layer Responsibilities

Layer	Responsibility	Section
Infrastructure	Physical node network: hardware tiers, energy sourcing, validator operations.	§5
Consensus	Ordering and finalizing blocks under PoSA; economic security and slashing.	§6
Execution & Service	EVM state transitions, gas market, EBS standards, BaaS, wallets, SDKs.	§7–§8
Governance	EarthDAO proposal, voting, treasury, and parameter-change machinery.	§10
Economic	EARTH utility currency: fees, staking, governance, service settlement.	§11, §15
Application	Enterprise products built on shared primitives.	§12
Intelligence	Trust infrastructure for autonomous AI agents.	§12.5
Ecosystem	Institutions, developers, and markets consuming and extending the stack.	§14

Interoperability (bridges and cross-chain messaging) is implemented within the Execution & Service Layer and specified separately in §9 given its security significance.

5. Infrastructure Layer — The Green Validator Network

GREENTECH · SUSTAINABLE PHYSICAL INFRASTRUCTURE

The validator base is deliberately inclusive, spanning three operator tiers designed to keep network participation affordable, geographically distributed, and energy-efficient. Inclusivity is not merely social policy: a validator set that anyone can join with commodity hardware raises the practical cost of censorship and collusion, because the marginal validator is cheap to add and hard to co-opt.

Validator Tier	Description	Indicative Role
Raspberry Pi Nodes	Low-cost, low-power single-board computers (≈5–15 W draw), lowering the barrier to entry for individual and community validators.	Decentralization breadth; community participation; observer and standby duty.
Solar Validators	Validator hardware powered directly by solar generation with battery buffering, aligning block production with renewable energy availability.	Renewable capacity; off-grid geographic reach; sustainability attestation.
Enterprise Validators	Institutional-grade servers operated by enterprises, universities, and consortium members requiring higher throughput and uptime guarantees.	Performance backbone; SLA-grade RPC; archive and indexing services.

Fig. 2 — Green Validator Network Composition

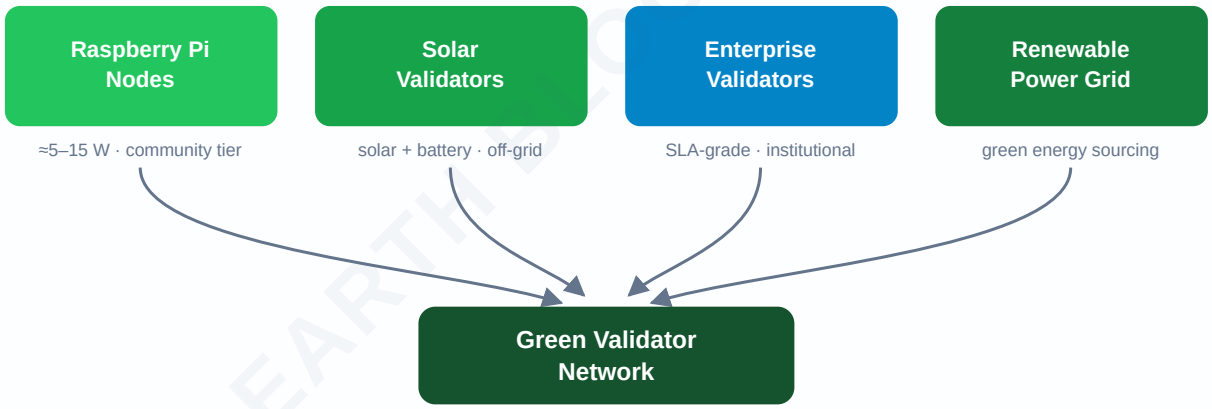


Fig. 2. Composition of the Green Validator Network across hardware tiers and power sources. All tiers participate in the same PoSA consensus; tiers differ in hardware class and service duties, not in trust assumptions.

5.1 Reference Hardware Specification

Parameter	Community Tier (minimum)	Enterprise Tier (recommended)
Compute	4-core ARM64 (Raspberry Pi 5 class)	8–16 vCPU x86-64 or ARM64 server
Memory	8 GB	32–64 GB
Storage	512 GB NVMe (pruned node)	2–4 TB NVMe (archive optional)
Network	50 Mbps symmetric	1 Gbps, redundant uplinks
Power	Grid or solar + battery (≥12 h buffer)	Renewable-sourced or offset, UPS-backed
Key management	Encrypted keystore	HSM or remote signer recommended

5.2 Validator Lifecycle

1. **Registration.** An operator submits a registration transaction binding node identity keys, network endpoints, a hardware/energy declaration, and the minimum self-stake in EARTH.
2. **Bonding.** Stake (self-bonded plus delegated) enters a bonded state and becomes slashable; the candidate joins the selection pool with an initial neutral reputation score.
3. **Activation.** At each epoch boundary the protocol admits the active set by stake- and reputation-weighted selection (§6.2). Non-selected candidates remain on standby, earning no block rewards but accruing uptime reputation as attesters.
4. **Operation.** Active validators propose and attest blocks, serve state to peers, and (optionally) operate BaaS/RPC endpoints for additional service revenue.
5. **Exit.** Voluntary exit or governance removal triggers an unbonding period of 21 days, during which stake remains slashable for faults committed while active — closing the “slash-and-run” window.

> **Green attestation.** Solar and renewable-powered validators may register an energy attestation (metering data or certified renewable procurement). EarthDAO’s sustainability programs (§10, §13) can direct incentive weight toward attested green capacity — making the network measurably greener as it grows.

6. Consensus Layer — Proof of Staked Authority (PoSA)

CONSENSUS THEORY · FORMAL SPECIFICATION · ECONOMIC SECURITY

Earth Blockchain secures its ledger with **Proof of Staked Authority (PoSA)**, a hybrid consensus model that combines stake-weighted validator selection with a bounded, reputation-scored authority set executing a BFT-style attestation protocol. PoSA is designed to deliver near-instant deterministic finality and low energy consumption while requiring meaningful, slashable economic commitment from validators to deter misbehavior.

6.1 Model and Assumptions

Parameter	Genesis Value (governable)
Active validator set size (n)	21 at genesis; expandable by EarthDAO as decentralization and performance targets are met.
Block time	3 seconds (target).
Epoch length	28,800 blocks (≈24 hours); active-set rotation and reward settlement occur at epoch boundaries.
Fault tolerance	Safety and liveness with up to f Byzantine validators, f < n/3 (standard BFT bound).
Finality	Deterministic after one quorum attestation of ≥ ⌈2n/3⌉ validators — typically 1–2 block intervals (≈3–6 s).
Unbonding period	21 days; stake remains slashable throughout.

6.2 Validator Selection Probability

At each epoch boundary, the probability that candidate validator *i* is admitted to the active set is proportional to the product of its bonded stake and its reputation score:

$$P(v_i) = (S_i \cdot R_i) \;/\; \Sigma_{j=1\ldots n}\,(S_j \cdot R_j)$$

where S_i is the EARTH bonded by (and delegated to) validator *i*, $R_i \in [0, 1]$ is its reputation score, and the sum runs over all candidates. Multiplying stake by reputation means capital alone cannot purchase authority: influence must be both bonded and earned.

6.3 Reputation Function

Reputation is computed on-chain from observable performance, so that it is auditable and cannot be granted discretionarily:

$$R_i = \text{clamp}(\, w_u \cdot U_i + w_a \cdot A_i - w_f \cdot F_i,\; 0,\, 1\,)$$

where $U_i \in [0,1]$ is trailing uptime, $A_i \in [0,1]$ is block-signing accuracy (valid, timely signatures over expected duties), and $F_i \geq 0$ is an exponentially decaying fault index accumulating protocol infractions. Genesis weights: $w_u = 0.4$, $w_a = 0.4$, $w_f = 0.2$ (EarthDAO-governable). New validators enter at $R = 0.5$, aligning admission with demonstrated reliability rather than incumbency.

6.4 Block Production and Deterministic Finality

Active validators produce blocks in a reputation-weighted round-robin schedule: the proposer rotation is deterministic within an epoch, with per-slot backup proposers to preserve liveness if the primary is silent. Each proposed block is attested by the active set; when signatures from at least ⌈2n/3⌉ validators are aggregated, the block is **final** — irreversible under the f < n/3 assumption. Finality is therefore deterministic (non-probabilistic): a single quorum confirmation suffices, in contrast to

longest-chain systems that require multiple confirmations to reach acceptable reorg probability. Deterministic finality is what allows ERP systems, payment processors, and autonomous agents to treat an Earth Blockchain confirmation as settlement, not as an estimate.

Fig. 3 — PoSA Consensus Flow

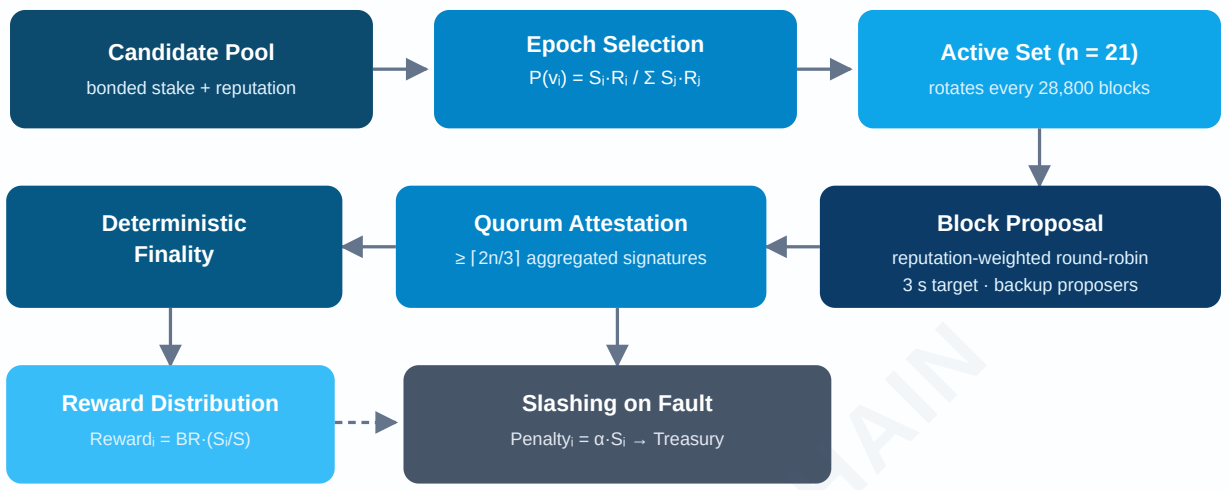


Fig. 3. End-to-end PoSA flow: stake- and reputation-weighted selection, rotating block proposal, quorum attestation to deterministic finality, epoch reward settlement, and slashing on fault.

6.5 Reward Distribution and Delegation

Block rewards for each interval are distributed pro-rata to bonded stake across the active set:

$$\text{Reward}_i = \text{BR}_t \times (S_i / S_{\text{total,active}})$$

where BR_t is the total block reward at time t drawn from the emission schedule (§15.4) plus the non-burned share of gas fees, and $S_{total,active}$ is the aggregate bonded stake of the active set.

Holders who do not operate hardware may **delegate** EARTH to a validator, sharing both rewards and slashing risk. For a delegator d bonded to validator i charging commission $c_i \in [0, 1]$:

$$\text{Reward}_d = (1 - c_i) \times \text{Reward}_i \times (S_d / S_i)$$

Delegation lets small holders secure the network through the community tier while concentrating operational duty in accountable operators.

6.6 Slashing Function

$$\text{Penalty}_i = \alpha \times S_i, \quad \alpha \in [0.01, 1.00]$$

The slashing coefficient α scales with fault severity. Slashed stake is redirected to the EarthDAO Treasury (§15.2), converting attacks and negligence into ecosystem resources.

Fault Class	Examples	Indicative α
Liveness fault	Missed block signatures, prolonged downtime beyond grace thresholds.	0.01 – 0.05
Protocol negligence	Serving invalid data, repeated late attestations, endpoint misconfiguration.	0.05 – 0.20
Equivocation	Double-signing conflicting blocks at the same height (Byzantine behavior).	0.50 – 1.00
Finality attack	Participation in an attested conflicting fork.	1.00

6.7 Economic Security and Threat Analysis

- **Cost of corruption.** Violating finality requires ≥ n/3 of the active set to equivocate, forfeiting up to their entire bonded stake under α = 1.0 slashing, in addition to reputation destruction that excludes them from future selection. The attack budget therefore scales with total bonded EARTH, which the emission schedule (§15.4) is designed to grow during the network's early years.
- **Long-range attacks.** Deterministic finality plus the 21-day slashable unbonding period removes the classic long-range rewrite: history behind a finalized checkpoint cannot be rewritten without keys that remain economically accountable.
- **Nothing-at-stake.** Attestation is slashable; signing conflicting histories is the most severely punished fault class, so rational validators attest exactly one chain.
- **Cartel resistance.** Reputation-weighted selection, epoch rotation, community-tier admission, and EarthDAO oversight of the validator framework raise the coordination cost of a persistent cartel; stake concentration metrics are public on-chain and via the network explorer.
- **Censorship resistance.** Rotating proposers and backup slots mean a censoring proposer only delays a transaction by seconds; sustained censorship requires supermajority collusion, which is detectable and governance-punishable.

7. Execution & Service Layer — EVM Runtime and BaaS

BLOCKCHAIN-AS-A-SERVICE · DEVELOPER INFRASTRUCTURE

The protocol core is a fully EVM-compatible runtime, giving developers a familiar smart-contract environment, and extends it with a Blockchain-as-a-Service (BaaS) surface purpose-built for enterprise integration. The design objective is that a Solidity team can deploy unchanged contracts on day one, while an enterprise IT team can integrate through managed APIs without operating a node at all.

7.1 EVM Runtime and State Model

Earth Blockchain executes the Ethereum Virtual Machine instruction set with an account-based state model: externally owned accounts (EOAs) and contract accounts, a global Merkle-Patricia state trie, and standard JSON-RPC. Existing Solidity and Vyper contracts, audit tooling, Hardhat/Foundry workflows, and wallet integrations function without modification. Protocol upgrades track relevant Ethereum improvements (opcode additions, account-abstraction support) through EarthDAO-ratified hard forks, keeping the runtime aligned with the broader EVM ecosystem.

7.2 Gas and Fee Market

Transactions pay fees in EARTH under a base-fee model designed for predictability:

$$\text{Fee} = \text{Gas}_{\text{used}} \times (\text{BaseFee}_t + \text{Tip})$$

The protocol adjusts $\textit{BaseFee}_t$ block-by-block toward a target gas utilization, damping fee volatility; a governable share β of collected base fees is burned (§15.6), and the remainder plus tips flows to validators. Enterprises consuming the network through BaaS may settle metered usage in EARTH at contracted rates, insulating line-of-business applications from per-transaction fee mechanics.

7.3 Transaction Lifecycle

Fig. 4 — Transaction Lifecycle Sequence

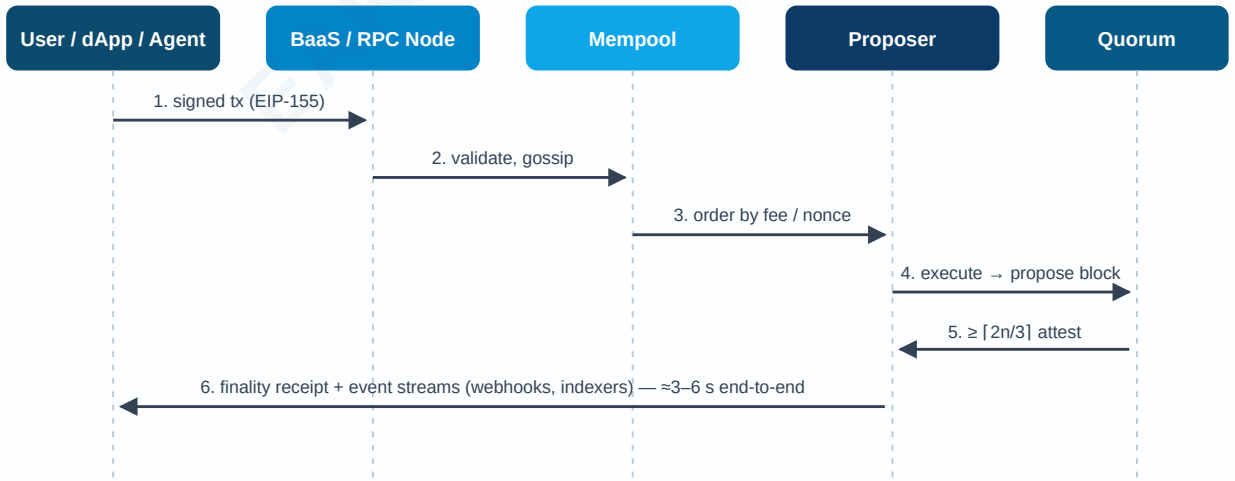


Fig. 4. Sequence of a transaction from submission through deterministic finality. BaaS consumers receive finality receipts and event streams without operating infrastructure.

7.4 Earth Wallets

Native wallet infrastructure serves both individual and institutional key management: **non-custodial wallets** (browser, mobile, hardware-wallet integration) for users and developers, and **custodial / MPC wallet services** for enterprises requiring role-based controls, transaction policies, and approval workflows. Account-abstraction support enables gas sponsorship, session keys, and spending limits — the primitives that consumer applications and AI agents (§12.5) both require.

7.5 BaaS Platform

Component	Function
Managed RPC & APIs	SLA-backed JSON-RPC, REST and streaming endpoints; enterprises integrate without running nodes.
Anchoring API	One-call notarization of document hashes and data commitments, used by EarthDoc, EarthESG, and EarthSCM.
Asset issuance API	Template-driven deployment of EBS-standard assets (§8) with policy configuration and key ceremony support.
Event & webhook service	Push notification of finalized events into ERP, CRM, and data-warehouse targets.
Indexing & analytics	Queryable historical state, compliance reporting exports, and explorer integration (scan.earth.ooo).
Permissioned subnets (roadmap)	Consortium deployments that anchor state commitments to the public network for auditability.

7.6 Developer Experience

- **SDKs.** TypeScript/JavaScript, Python, Go, and Java client libraries; contract templates and reference implementations for every EBS standard.
- **Tooling compatibility.** Hardhat, Foundry, Remix, ethers.js/viem, and standard block-explorer verification work out of the box.
- **Test infrastructure.** Public testnet with faucet, deterministic local devnet images, and CI-ready network fixtures.
- **Grants.** The Ecosystem & Developer Grants allocation (§15.2) funds builders, hackathons, integrations, and BaaS adoption incentives through EarthDAO programs.

8. Earth Blockchain Standards (EBS)

NATIVE, EVM-COMPATIBLE ASSET & IDENTITY STANDARDS

Earth Blockchain Standards (EBS) are the network's native smart-contract standards. Each EBS standard is **interface-compatible with its Ethereum (ERC) lineage** — existing tooling, wallets, and auditors work unchanged — while shipping as an audited, protocol-maintained reference implementation with enterprise policy hooks (role-based administration, compliance modules, and BaaS issuance templates). Together they give every Earth product, and every third-party builder, a common asset vocabulary: the same standards that power a carbon credit also power a bond, a diploma, and an AI agent's on-chain identity.

Standard	Asset Class	Lineage	Primary Role in the Ecosystem
EBS-20	Fungible assets	ERC-20	Payment and utility units, stable-value instruments, fungible carbon units.
EBS-721	Non-fungible assets (NFTs)	ERC-721	Unique assets: serialized goods, land parcels, certificates, artworks.
EBS-1155	Multi-token assets	ERC-1155	Batched classes of assets: credit vintages, ticket classes, component lots.
EBS-1400	Security assets	ERC-1400	Partitioned, document-bound securities with forced-transfer controls for regulated issuance.
EBS-3643	Permissioned RWAs	ERC-3643	Identity-gated real-world assets: transfers validated against on-chain eligibility claims.
EBS-4671	Verifiable credentials	ERC-4671	Non-tradable attestations: degrees, licenses, memberships, audit findings.
EBS-5192	Soulbound assets	ERC-5192	Permanently bound records: identity badges, sanctions-screening flags, reputation.
EBS-3525	Semi-fungible assets	ERC-3525	ID + slot + value model: bonds by tranche, invoices by debtor, credits by project.
EBS-6551	Token-bound accounts	ERC-6551	Every NFT becomes an account that can own assets and act — the substrate of AI agent identity.

Fig. 5 — EBS Standards Map: Families and Product Consumption

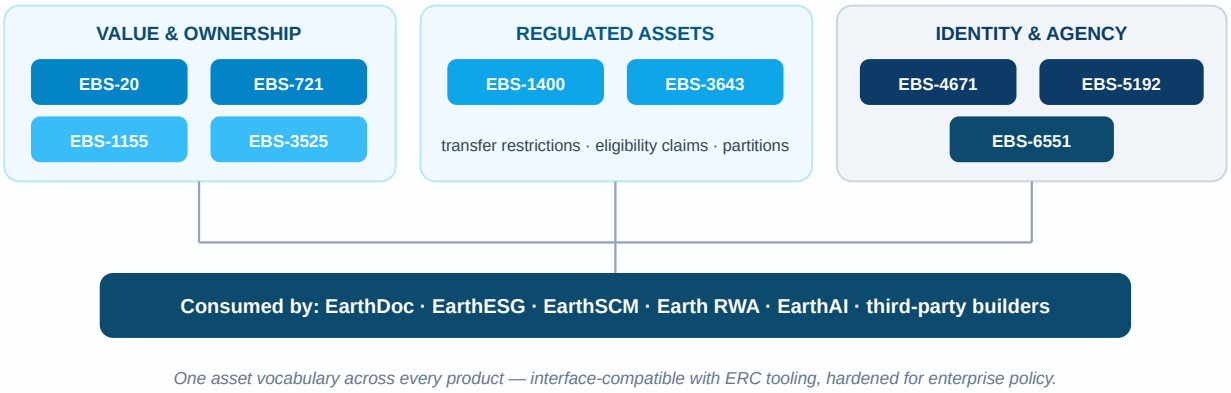


Fig. 5. The nine EBS standards grouped by family. Products compose standards rather than inventing bespoke contracts, keeping the ecosystem interoperable and auditable.

8.1 Standards in Detail

EBS-20 — Fungible Assets

The base standard for interchangeable units of value: ecosystem payment instruments, loyalty and settlement units, wrapped representations of bridged assets, and fungible environmental units (e.g., pooled carbon allowances in EarthESG). Enterprise extensions add mint/burn role separation, pausability, and allow-list hooks. Note: EARTH itself is the network's native currency at the protocol level, not an EBS-20 contract; a canonical wrapped form (wEARTH) exists for contract composability.

EBS-721 — Non-Fungible Assets

Unique, indivisible assets with per-item metadata and provenance history: serialized industrial components in EarthSCM, land parcels and unique property titles in Earth RWA, and one-of-one certificates in EarthDoc. Its enterprise profile standardizes revocation registries and metadata integrity commitments (content hashes on-chain, payloads off-chain).

EBS-1155 — Multi-Token Assets

A single contract managing many asset classes, fungible and non-fungible, with batch operations that cut gas costs for high-volume issuance. EarthESG issues carbon credits as EBS-1155 classes keyed by project and vintage; EarthSCM uses it for component lots and batch certifications.

EBS-1400 — Security Assets

A partitioned security standard for regulated instruments: tranches and lock-up classes as partitions, mandatory document references bound to issuance, controller (forced-transfer) operations for legal recovery, and granular transfer-restriction error signaling. Earth RWA uses EBS-1400 for instruments that behave like securities — bonds, fund units, revenue-share notes.

EBS-3643 — Permissioned Real-World Assets

An identity-gated asset standard: every transfer is validated on-chain against eligibility claims held in an identity registry (jurisdiction, accreditation, KYC status), issued by approved claim providers. This moves compliance from off-chain paperwork into deterministic contract logic — the pattern institutional RWA issuance requires. EBS-3643 is the default rail for Earth RWA distributions to verified investors.

EBS-4671 — Verifiable Credentials

Non-tradable attestations issued by identifiable issuers and held by subjects: university degrees, professional licenses, vendor accreditations, audit findings. Credentials are individually revocable by the issuer, enumerable per holder, and verifiable by any third party without contacting the issuer — the contract layer beneath EarthDoc.

EBS-5192 — Soulbound Assets

A minimal locking interface that renders an asset permanently non-transferable. Used where the binding itself is the guarantee: validator identity badges, sanctions-screening and eligibility flags consumed by EBS-3643 registries, and reputation records for EarthAI agents that must not be transferable by construction.

EBS-3525 — Semi-Fungible Assets

The ID + slot + value model: each asset has a unique ID, belongs to a slot (class), and carries a divisible quantity. Value can move between assets of the same slot, enabling instruments that are unique in identity but fungible in quantity — bonds by tranche, invoices by debtor and maturity, and carbon credit lots that must split and merge cleanly during retirement.

EBS-6551 — Token-Bound Accounts

Gives every EBS-721 asset its own smart-contract account able to hold assets and execute transactions. A machine identity minted as an NFT thereby becomes an *actor*: an EarthAI agent whose wallet, credentials (EBS-4671), reputation (EBS-5192), and spending mandates all hang off one on-chain root; a digital product passport in EarthSCM that owns its inspection credentials and warranty records.

> **Ecosystem benefit.** Because all five enterprise products and all third-party builders compose the same nine standards, integrations are written once: a custodian that supports EBS-3643 supports every permissioned asset on the network; an auditor that can read EBS-4671 can verify any credential, from a diploma to an AI agent’s mandate.

9. Interoperability & Cross-Chain Architecture

BRIDGES · MESSAGING · ENTERPRISE SYSTEM INTEGRATION

No enterprise adopts a settlement layer that is an island. Earth Blockchain's interoperability design spans three planes: **asset bridging** with other major networks, **generalized message passing** for cross-chain application logic, and **enterprise system integration** through the BaaS surface (§7.5).

9.1 Canonical Bridge Design

The canonical bridge uses a lock-and-mint / burn-and-release model hardened by defense-in-depth: transfers are attested by an independent validator-operated attestation set (distinct keys from consensus duty), verified against finalized source-chain state, rate-limited per asset, and pausable by a guardian process under EarthDAO oversight. Deterministic finality on Earth Blockchain (§6.4) materially simplifies the inbound trust problem for counterpart chains: there is no reorg window to insure against.

Fig. 6 — Canonical Bridge: Lock-and-Mint Flow

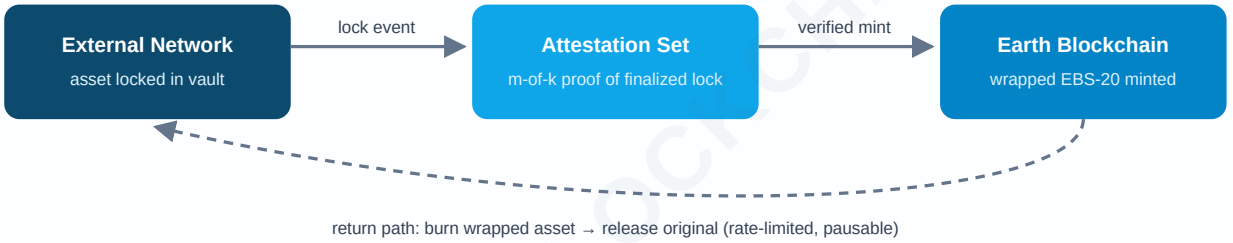


Fig. 6. Lock-and-mint with independent attestation, finality verification, per-asset rate limits, and a guardian pause path governed by EarthDAO.

9.2 Cross-Chain Messaging and Standards Alignment

Beyond asset transfer, a generalized message channel lets contracts on Earth Blockchain consume verified events from external networks and vice versa — enabling, for example, a carbon credit retired on Earth Blockchain to be reflected in an external registry contract. Because EBS standards preserve ERC interfaces (§8), bridged assets and messages arrive in formats external tooling already understands, and Earth-native assets can be represented faithfully elsewhere.

9.3 Enterprise Integration Plane

For institutions, interoperability equally means ERP, registry, and data-platform connectivity: BaaS webhooks and indexers stream finalized events into SAP/Oracle-class systems; the anchoring API lets existing document-management and MRV systems gain on-chain verifiability without migration; and permissioned subnet deployments (roadmap) anchor consortium state to the public network for public auditability with private throughput.

10. Governance Layer — EarthDAO

DECENTRALIZED, VALIDATOR-ANCHORED ON-CHAIN GOVERNANCE

EarthDAO is the network's on-chain governance framework, built on the premise that validators — the network's accountable infrastructure operators — together with EARTH stakers are best positioned to steer protocol evolution. Governance influence is earned by commitment: voting power derives from EARTH explicitly staked to governance, with time-locking rewarded, so that long-term aligned participants outweigh short-term holders.

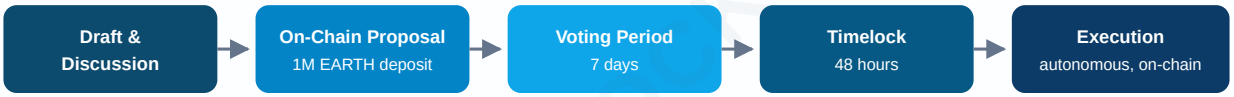
10.1 Voting Power

$$VP_i = G_i \times (1 + \lambda \cdot L_i / L_{max})$$

where G_i is EARTH staked to governance by participant i, L_i is the chosen lock duration, L_{max} = 24 months, and $\lambda = 1$ at genesis — so a maximum-duration lock doubles voting weight. Parameters are themselves governable.

10.2 Proposal Lifecycle

Fig. 7 — EarthDAO Proposal Lifecycle



Quorum ≥ 20% of governance-staked EARTH · standard proposals >50% approval · protocol upgrades ≥ 66.7% supermajority

Fig. 7. Proposal lifecycle from draft to autonomous execution. Failed proposals forfeit a share of the deposit to the Treasury, deterring spam; the timelock gives integrators a guaranteed reaction window.

10.3 Governance Scope

Governance Area	Scope
Protocol upgrades	Hard forks, EVM feature adoption, consensus parameters (n, epoch length, slashing coefficients, reputation weights).
Treasury management	Direction of the DAO Reserve and slashed-stake inflows; ecosystem funding and long-term stewardship.
Validator framework	Admission rules, tier definitions, green-attestation requirements, and evolution of the PoSA program.
Economic parameters	Fee-burn share β, base-fee targets, emission calibration within the fixed 90B cap.
Enterprise adoption	Prioritization of BaaS capabilities and initiatives that bring institutions on-chain.
Sustainability programs	Funding for green validator incentives and carbon-infrastructure development.
Strategic partnerships	Approval of ecosystem partnerships, bridge deployments, and integrations.

Design intent: governance that is transparent, on-chain, and aligned with long-horizon participants. Progressive decentralization milestones — expanding the active validator set, transferring remaining administrative keys to EarthDAO control, and sunsetting guardian powers — are tracked publicly on the roadmap (§16).

11. Economic Layer — The EARTH Utility Currency

THE NETWORK'S NATIVE CURRENCY

EARTH is the native utility currency of Earth Blockchain — issued and accounted at the protocol level, not as a smart-contract token. It is designed to accrue value through network utility and adoption rather than short-term speculation, and performs four core functions that bind every layer of the stack into one economy:

Fig. 8 — EARTH: Core Utility Roles

Fig. 8. EARTH's four utility roles: gas, staking security, governance stake, and enterprise service settlement.

Utility Function	Description
Gas fees	EARTH is required to pay for transaction execution and smart-contract computation (§7.2); a governed share of base fees is burned (§15.6).
Staking & security	Validators bond and delegators delegate EARTH to secure PoSA consensus, earning emission-funded rewards (§6.5, §15.4).
Governance stake	EARTH staked to governance confers EarthDAO voting power, with time-lock weighting (§10.1).
Enterprise settlement	EARTH is the settlement unit for BaaS API access, verification services, product subscriptions, and marketplace fees across the suite (§12).

Demand for EARTH therefore scales with the network's real usage — transactions executed, stake securing consensus, governance participation, and enterprise services consumed — while supply is bounded by a fixed 90-billion cap with decaying emission and a fee-burn counterweight (§15). The complete quantitative model is specified in §15.

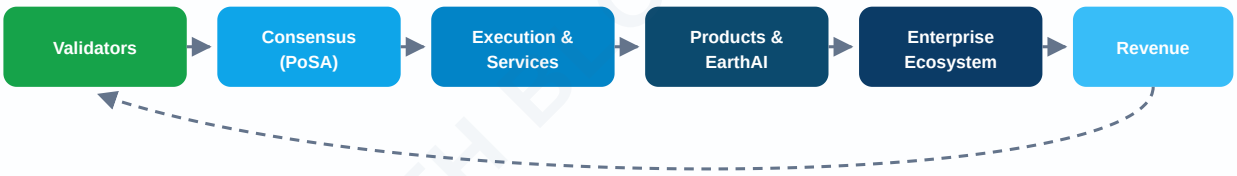
12. Application Layer — Enterprise Product Suite

PURPOSE-BUILT APPLICATIONS ON ONE SHARED, VERIFIABLE FOUNDATION

Earth Blockchain's ecosystem strategy channels the underlying infrastructure into five purpose-built products, each addressing a distinct enterprise use case on the same ledger, the same EBS standards, and the same EARTH settlement rail. Because the products share primitives, they compound: a supplier verified in EarthSCM can present EarthDoc credentials, report emissions through EarthESG, finance its invoices through Earth RWA, and delegate procurement to an EarthAI agent — all against one consistent trust fabric.

Product	Category	Core EBS Standards Used
EarthDoc	Verifiable documents & credentials	EBS-4671, EBS-5192, EBS-721
EarthESG	Sustainability reporting & carbon credits	EBS-1155, EBS-20, EBS-4671, EBS-3525
EarthSCM	Supply chain traceability & intelligence	EBS-721, EBS-1155, EBS-6551, EBS-4671
Earth RWA	Real-world asset tokenization	EBS-3643, EBS-1400, EBS-3525, EBS-721
EarthAI	Machine trust layer	EBS-6551, EBS-4671, EBS-5192, EBS-20

Fig. 9 — Ecosystem Value Flow Loop



Ecosystem revenue recirculates as validator & staking rewards and Treasury inflows — a closed-loop economy.

Fig. 9. Value flows upward from infrastructure to enterprises; service revenue and fees recirculate downward as security rewards and Treasury resources.

12.1 EarthDoc — Verifiable Documents & Credentials

What it is. EarthDoc makes any document or credential independently verifiable in seconds: degrees, licenses, land records, contracts, invoices, lab reports, and government certificates. The document itself never leaves the issuer's custody — only a cryptographic commitment is anchored on-chain.

Architecture & technical design. Issuers register a decentralized identity and signing keys. Each document is hashed (SHA-256) client-side; the hash, issuer signature, schema reference, and validity window are committed via the BaaS anchoring API. Credential-type documents are additionally issued as EBS-4671 attestations to the holder's address (or EBS-5192 where non-transferability must be structural), with revocation registries under issuer control. Verification is a stateless read: recompute the hash, check the anchor, check issuer identity and revocation — no call to the issuer required. Selective-disclosure schemas allow a holder to prove a property (e.g., "degree awarded, year ≥ 2020") without revealing the full document.

Workflow

1. **Issue.** Issuer hashes and signs the document; anchor transaction finalizes in seconds; holder receives the credential in an Earth Wallet or via QR-embedded PDF.
2. **Present.** Holder shares the document (or a selective proof) through any channel — email, portal, QR.
3. **Verify.** Verifier recomputes the hash and checks anchor, issuer, and revocation state on-chain — free of issuer availability, in under a second.
4. **Revoke / renew.** Issuer updates the revocation registry; all future verifications reflect the change immediately.

Fig. 10 — EarthDoc: Issue → Present → Verify

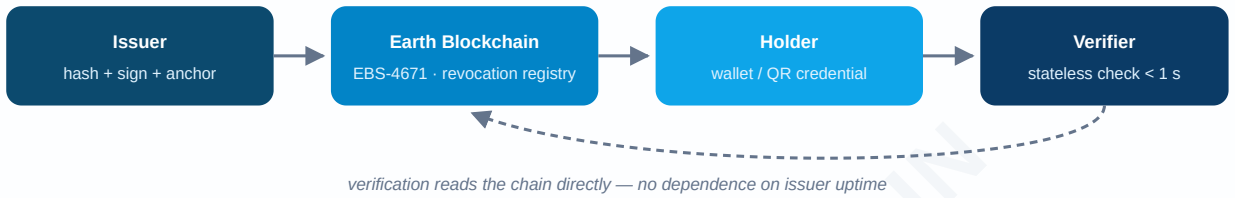


Fig. 10. EarthDoc lifecycle. Documents stay off-chain; only commitments, issuer identity, and revocation state live on-chain.

Dimension	EarthDoc
Target customers	Universities and boards of education; government registries and e-governance programs; certification and standards bodies; HR/background-check firms; banks (KYC document validation); hospitals and labs.
Business model	SaaS issuance subscription per issuer + per-anchor and per-verification metering settled in EARTH; white-label deployments for governments and universities.
Revenue opportunities	Issuance volume fees, verification API metering, integration/onboarding services, archival anchoring of legacy records at scale.
Competitive advantage	Deterministic sub-second verification on a green network; standards-based credentials portable across the whole ecosystem; issuer-sovereign data custody (no honeypot of documents).

Enterprise use cases. Degree and transcript verification for admissions and hiring; tamper-evident land and property records; export/import certificates of origin; pharmaceutical batch certificates; audit-firm work-product attestation; instantly verifiable government-issued licenses and permits.

12.2 EarthESG — Sustainability, Reporting & Carbon Credits

What it is. EarthESG is the suite's sustainability intelligence platform: enterprise ESG data management and disclosure tooling with **carbon-credit infrastructure integrated as a native capability** — measurement, issuance, trading, and retirement of carbon assets on the same rails as the reporting that references them. Unifying reporting and carbon markets in one product eliminates the reconciliation gap that plagues both: every disclosed number can point to its evidence, and every credit points to its project data.

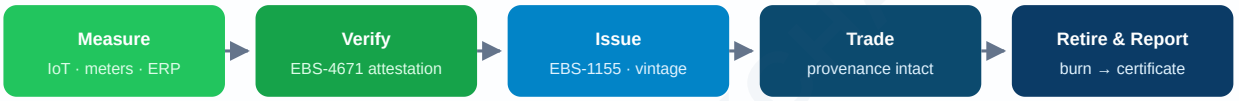
Architecture & technical design. An ingestion layer collects emissions and sustainability data from meters, IoT gateways, utility feeds, ERPs, and supplier declarations (the latter arriving as EarthDoc-verified attestations). A computation layer applies emission factors and methodology templates aligned in structure with the GHG Protocol and disclosure regimes such as the EU's CSRD/ESRS and India's BRSR, producing evidence-linked datasets whose commitments are anchored on-chain. The carbon module issues credits as EBS-1155 classes keyed by project and vintage after verifier sign-off (recorded as EBS-4671 attestations); EBS-3525 lots support clean splitting and merging; retirement burns the asset and mints an

immutable retirement certificate referenced directly in ESG reports. Alignment with reporting frameworks describes structure and intent of the tooling, not formal regulatory certification.

Workflow — carbon credit lifecycle

1. **Measure.** Project or facility data flows into the MRV (measurement, reporting, verification) pipeline; raw-data commitments are anchored as they arrive.
2. **Verify.** An accredited verifier reviews the evidence trail and signs an EBS-4671 verification attestation on-chain.
3. **Issue.** Credits are minted as EBS-1155 assets (project × vintage), carrying methodology and verification references in metadata.
4. **Transfer / trade.** Credits move between eligible registries, brokers, and buyers with full provenance; double-counting is structurally impossible on one ledger.
5. **Retire & report.** The buyer burns credits; the retirement certificate is cited in the buyer's EarthESG disclosure, closing the loop from claim to evidence.

Fig. 11 — EarthESG: Integrated Carbon Credit Lifecycle



retirement certificates are cited directly inside CSRD/BRSR-structured disclosures — claim and evidence on one ledger

Fig. 11. The carbon lifecycle inside EarthESG, from measurement to retirement, with verification attestations and immutable audit trail at every step.

Dimension	EarthESG
Target customers	Listed and multinational enterprises under disclosure mandates; carbon project developers and registries; sustainability consultancies and assurance firms; banks assessing financed emissions; public agencies running carbon programs.
Business model	Platform subscription tiered by entities and data volume; marketplace take-rate on credit issuance and transfers; per-retirement certification fees — settled in EARTH.
Revenue opportunities	Disclosure tooling seats, MRV pipeline services, registry-integration licensing, verified-data API access for lenders and insurers.
Competitive advantage	Reporting and carbon assets on one verifiable ledger (no reconciliation gap); a credibly low-power chain hosting the market — the infrastructure's own footprint doesn't undermine the product; supplier data arrives pre-verified via EarthDoc/EarthSCM.

Enterprise use cases. CSRD/ESRS- and BRSR-structured disclosure preparation with evidence links; corporate net-zero program tracking across subsidiaries; high-integrity voluntary carbon-market issuance; Scope 3 supplier data collection with verifiable attestations; green-bond impact reporting.

12.3 EarthSCM — Supply Chain Traceability & Intelligence

What it is. EarthSCM gives enterprises end-to-end provenance for physical goods: every custody transfer, process step, inspection, and environmental condition recorded as verifiable events against a digital identity for each item or lot.

Architecture & technical design. Physical items or lots are minted as EBS-721 assets (serialized goods) or EBS-1155 classes (batches), each optionally carrying an EBS-6551 token-bound account — a "digital product passport" that itself

holds inspection credentials (EBS-4671), certificates, and warranty records. Events enter through an oracle layer: GS1-compatible barcode/RFID scans, IoT sensor gateways (temperature, humidity, shock, geolocation), and ERP adapters. High-frequency telemetry is batched and Merkle-anchored for cost efficiency, with full data retained in the participant's systems and provable on demand. Role-based visibility lets competitors share one chain of custody without exposing commercial terms.

Workflow

1. **Register.** Producer mints the item/lot identity and binds initial certificates to its passport.
2. **Track.** Each handler appends custody and condition events; IoT gateways anchor telemetry commitments automatically.
3. **Certify.** Inspectors and labs attach EBS-4671 attestations (quality, origin, sustainability) at checkpoints.
4. **Prove.** Buyers, customs, and consumers verify the full history by scanning the item — recalls trace affected lots in minutes, not weeks.

Fig. 12 — EarthSCM: Provenance Pipeline with Oracle Layer

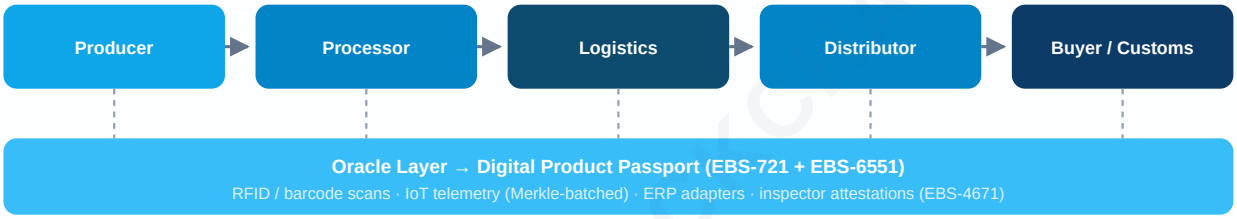


Fig. 12. Custody chain with an oracle layer anchoring events to each item's token-bound passport. Full telemetry stays with participants; commitments make it provable.

Dimension	EarthSCM
Target customers	Manufacturers and exporters; pharmaceutical and food cold chains; agricultural cooperatives and commodity traders; luxury and electronics brands fighting counterfeits; ports, 3PLs, and customs modernization programs.
Business model	Per-item/lot passport fees plus event-volume metering in EARTH; enterprise subscriptions for dashboards, analytics, and ERP connectors; network fees for multi-party consortium deployments.
Revenue opportunities	Passport issuance at manufacturing scale, IoT gateway certification, compliance-report exports (e.g., deforestation-free and forced-labor regimes), recall-management tooling.
Competitive advantage	Item-level identity with token-bound accounts (passports that own their own credentials); native hand-off into EarthESG for Scope 3 data and EarthDoc for trade documents; low, predictable event costs by design.

Enterprise use cases. Pharma serialization and cold-chain integrity; food origin and organic certification; conflict-mineral and battery-passport compliance; anti-counterfeit verification for luxury goods; export documentation bound to physical shipments.

12.4 Earth RWA — Real-World Asset Tokenization

What it is. Earth RWA is the issuance and lifecycle platform for on-chain representations of real-world assets — property, invoices, commodities, funds, and fixed-income instruments — engineered for regulated distribution from the first block.

Architecture & technical design. Issuance is compliance-first: investors onboard through KYC/eligibility providers who write claims to an on-chain identity registry; assets are issued as EBS-3643 permissioned assets (identity-gated transfers) or EBS-1400 security assets (partitions, document binding, controller operations), with EBS-3525 supporting tranche-structured and quantity-divisible instruments and EBS-721 unique titles. Legal enforceability is anchored by binding the instrument's governing documentation hash into the asset itself; custodians and trustees hold controller roles for court-ordered actions. Lifecycle automation — coupon and rental distributions, redemptions, corporate actions — executes as auditable contract logic, with payments in EARTH or approved settlement assets.

Workflow — tokenization lifecycle

1. **Structure.** Issuer, legal counsel, and custodian define the instrument; documentation hashes are bound on-chain (EarthDoc anchoring).
2. **Onboard.** Investors receive eligibility claims (jurisdiction, accreditation) in the identity registry.
3. **Issue.** Assets are minted under EBS-3643/EBS-1400 with transfer policies encoded; primary distribution settles atomically against payment.
4. **Service.** Distributions, reporting, and corporate actions run on-chain; every action is regulator-auditable.
5. **Transfer / redeem.** Secondary transfers execute only between eligible holders; redemption burns the asset against final settlement.

Fig. 13 — Earth RWA: Compliance-Gated Tokenization Lifecycle

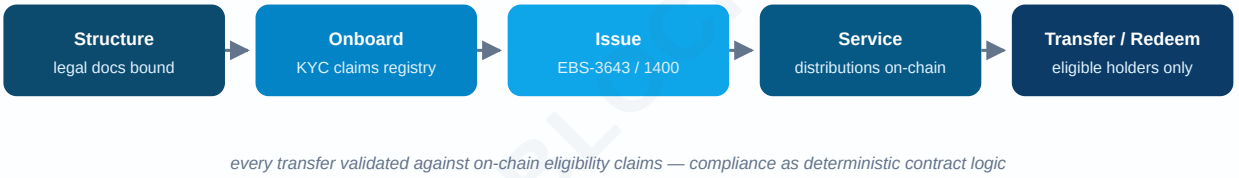


Fig. 13. RWA lifecycle from structuring to redemption. Custodian/trustee controller roles support legally mandated actions without breaking auditability.

Dimension	Earth RWA
Target customers	Asset managers and fund administrators; NBFCs and banks (invoice/trade finance); real-estate developers and REIT-like structures; commodity warehouses; government asset-monetization and registry programs.
Business model	Issuance fees per instrument; annualized platform fee on assets under administration (bps); lifecycle-servicing subscriptions; secondary-transfer fees — settled in EARTH.
Revenue opportunities	Tokenization-as-a-service for institutions, identity-claim network fees, custodian/trustee integrations, data feeds to lenders pricing tokenized collateral.
Competitive advantage	Compliance primitives are native standards, not bespoke add-ons; deterministic finality suits settlement obligations; composability with EarthDoc (documents), EarthSCM (physical collateral provenance), and EarthESG (green-asset labeling).

Enterprise use cases. Invoice and trade-receivable financing pools; fractional commercial real estate with automated rental distribution; warehouse-receipt commodity financing; tokenized bond and fund-unit issuance to verified investors; green-labeled instruments whose sustainability claims are EarthESG-verified.

12.5 EarthAI — The Machine Trust Layer

What it is. EarthAI extends the network's trust guarantees to autonomous software agents — giving AI systems verifiable identity, scoped authority, auditable decision trails, and native payment rails, so machine-initiated transactions can be trusted with the same rigor as human-initiated ones. It is both the suite's fifth product and the Intelligence Layer of the protocol stack (§4).

Architecture & technical design. An agent's root identity is an EBS-721 asset controlled by its principal (a person or organization), extended with an EBS-6551 token-bound account that serves as the agent's wallet and execution surface. The principal issues **mandates** — EBS-4671 credentials encoding scoped, expiring authority (spend limits, counterparty classes, action types) — while non-transferable track-record and compliance flags accrue as EBS-5192 records. Policy contracts enforce mandates at execution time: an agent cannot exceed its authority even if compromised, and every action it takes is signed, final, and attributable. Verification services let counterparties (human or machine) check an agent's identity, mandate, and reputation in one read before transacting. Micropayment channels support machine-speed, machine-scale settlement in EARTH for API calls, data, and services.

Workflow

1. **Register.** Principal mints the agent identity and its token-bound account.
2. **Mandate.** Principal issues scoped authority credentials; funds the agent's account within limits.
3. **Act.** The agent negotiates and transacts; policy contracts check every action against its live mandate.
4. **Audit.** Decision trails are anchored; principals, auditors, and counterparties replay exactly what the agent did and under what authority.
5. **Revoke.** Mandates expire or are revoked instantly; the agent's authority dies with them, its history does not.

Fig. 14 — EarthAI: Agent Identity & Trust Stack

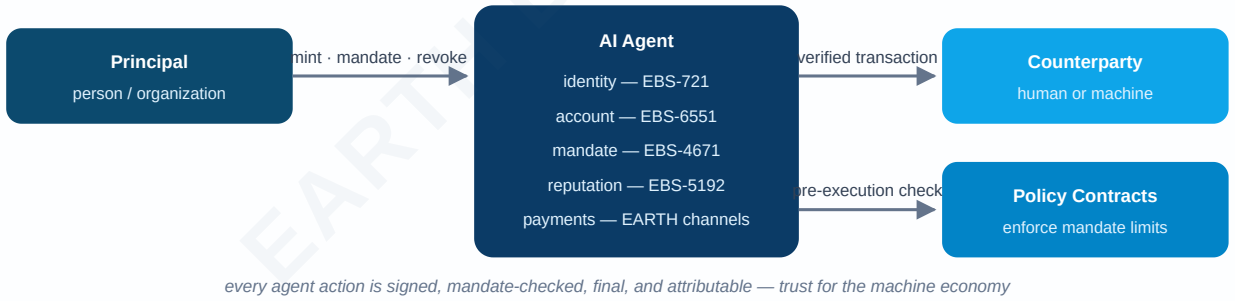


Fig. 14. The agent trust stack: one on-chain root binds identity, account, authority, reputation, and payments.

Dimension	EarthAI
Target customers	Enterprises deploying autonomous procurement, treasury, and operations agents; AI platform vendors needing accountable execution; data and API marketplaces; financial institutions piloting agentic workflows; regulators requiring AI audit trails.
Business model	Per-agent identity and mandate fees; verification API metering; micropayment channel fees; enterprise policy-suite subscriptions — settled in EARTH.
Revenue opportunities	Agent registry network effects, compliance and audit tooling for AI governance regimes, agent-to-agent commerce settlement volume, reputation data services.
Competitive advantage	Agency modeled with open standards (identity, account, mandate, reputation) rather than platform lock-in; deterministic finality at machine speed; the only suite where an agent's counterparties — documents, credits, assets, shipments — are natively verifiable on the same chain.

Enterprise use cases. Autonomous procurement agents transacting within board-approved mandates; AI treasury operations with on-chain spend policies; machine-to-machine data and compute markets; auditable AI decision trails for regulated industries; agent-verified interactions between fleets of enterprise copilots.

13. Sustainability & ESG Alignment

GREENTECH BY DESIGN, NOT BY OFFSET

Sustainability is embedded at the protocol level, not layered on afterward. PoSA consensus (§6) performs no energy-intensive computation by construction; the Green Validator Network (§5) actively favors renewable-powered and low-power hardware; and EarthESG (§12.2) gives enterprises — and the network itself — the tooling to measure and report sustainability impact on-chain.

Sustainability Dimension	Earth Blockchain Approach
Energy consumption	Low-power PoSA validation; a full validator can run on single-board hardware drawing 5–15 W — orders of magnitude below proof-of-work mining.
Validator hardware & power	Raspberry Pi–class and solar-powered tiers with on-chain green attestations (§5.2).
Network-level transparency	The network's own energy profile is reported through EarthESG — the chain uses its own product to disclose itself.
Enterprise ESG enablement	EarthESG carbon accounting and disclosure tooling structured for CSRD/ESRS- and BRSR-style regimes.
Governance oversight	EarthDAO allocates dedicated funding to sustainability programs and green validator incentives (§10.3).

> **Why it matters commercially.** For enterprises bound by disclosure mandates, the settlement layer's footprint is part of their own Scope 3 story. A verifiably low-power network is not a branding preference — it is a procurement requirement Earth Blockchain is built to satisfy.

14. Enterprise Adoption & Go-to-Market

FROM PILOT TO PRODUCTION ON ONE STACK

Earth Blockchain's adoption strategy recognizes how institutions actually buy infrastructure: through bounded pilots, procurement-compatible integration, and progressive commitment — not speculative leaps. The BaaS surface (§7.5) exists precisely so that the first integration requires no blockchain expertise, no node operations, and no balance-sheet exposure beyond metered service fees.

14.1 Target Segments

Segment	Entry Products	Expansion Path
Governments & public agencies	EarthDoc (records, certificates), EarthESG (public carbon programs)	Registry modernization, e-governance anchoring, public RWA programs.
Universities & certification bodies	EarthDoc (degrees, licenses)	Research provenance, campus validator nodes, developer talent pipeline.
Financial institutions	Earth RWA (invoices, funds), EarthDoc (KYC documents)	Tokenized collateral data, financed-emissions reporting via EarthESG.
Manufacturers & exporters	EarthSCM (traceability)	Scope 3 via EarthESG, trade docs via EarthDoc, receivables via Earth RWA.
Carbon & ESG markets	EarthESG (issuance, MRV, retirement)	Registry integrations, green-labeled RWA instruments.
AI platforms & enterprises	EarthAI (agent identity, audit)	Agent commerce, machine payments, policy tooling.

14.2 Adoption Journey

1. **Pilot (weeks).** A bounded use case — e.g., verifying one credential type or anchoring one report — through BaaS APIs, priced as metered service.
2. **Integration (months).** ERP/registry connectors, webhook event streams, role-based wallets; success metrics defined in the customer's language (fraud reduction, audit hours saved, settlement time).
3. **Production (quarters).** Volume issuance, multi-department rollout, optional enterprise validator participation — converting the customer from consumer to stakeholder in network security and governance.

14.3 Ecosystem Development

The Ecosystem & Developer Grants and Enterprise & Partnership Reserve allocations (§15.2) fund the flywheel: reference integrations, system-integrator enablement, university programs, hackathons, and co-developed lighthouse deployments with governments and industry consortia. Public-sector engagement prioritizes programs where verifiability is the product — records, disclosures, subsidies, and registries — and where a sustainable network is a procurement advantage rather than a footnote.

15. Economic Model of EARTH (Tokenomics)

EARTH — NATIVE UTILITY CURRENCY · MAXIMUM SUPPLY: 90,000,000,000

This section specifies the complete economic design of EARTH: fixed supply, allocation, vesting, emission, staking yield, and the deflationary counterbalance. The design goal is **credible scarcity with security-first distribution** — the majority of supply flows to the parties who secure and build the network, on schedules that reward patience and punish extraction.

15.1 Supply Parameters

Parameter	Value
Maximum supply	90,000,000,000 EARTH (fixed cap; no mechanism can exceed it).
Monetary standard	Native Layer-1 currency issued at the protocol level; canonical wrapped form (wEARTH, EBS-20) for contract composability; wrapped representations on external networks via the canonical bridge (§9).
Initial circulating supply	Public/Community allocation plus an activated portion of the Ecosystem allocation — finalized at the Genesis Distribution Event (GDE).
Issuance model	Disinflationary: fixed cap with exponentially decaying emission (§15.4) and a governable fee burn (§15.6).

15.2 Allocation

Fig. 15 — EARTH Allocation (Maximum Supply: 90,000,000,000)

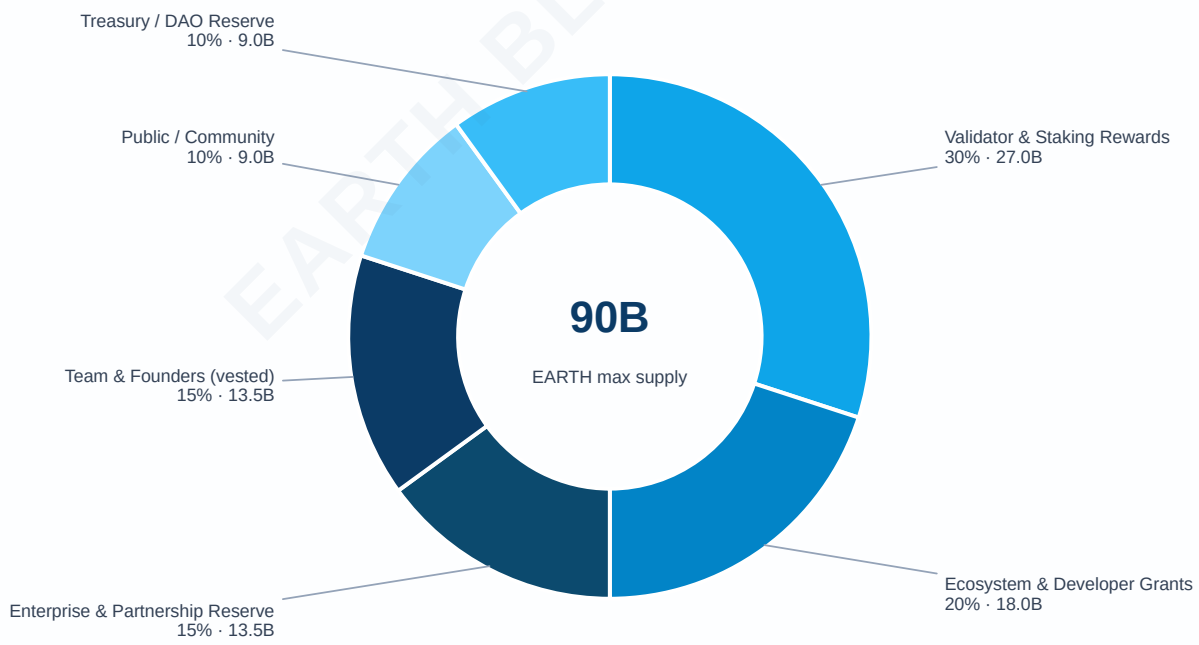


Fig. 15. Allocation of the 90-billion maximum supply across six categories. Sixty percent is reserved for network security, builders, and enterprise adoption.

Category	%	EARTH (B)	Purpose & Release Discipline
Validator & Staking Rewards	30%	27.0	Long-term PoSA emission pool released per §15.4; never pre-circulated.
Ecosystem & Developer Grants	20%	18.0	Builder grants, hackathons, BaaS adoption incentives; milestone-gated under EarthDAO programs.
Enterprise & Partnership Reserve	15%	13.5	Strategic enterprise onboarding and integration deals; deal-vested.
Team & Founders	15%	13.5	12-month cliff, then 36-month linear vesting (§15.3).
Public / Community	10%	9.0	Public distribution, community rewards, airdrops.
Treasury / DAO Reserve	10%	9.0	EarthDAO-governed reserve for network resilience; also receives slashed stake and any burned-deposit inflows.

15.3 Vesting Function (Team & Founders)

$$\text{Vested}(t) = 0, \quad \text{for } t < T_{cliff}$$

$$\text{Vested}(t) = \text{Total} \times \min(1, (t - T_{cliff}) / T_{vest}), \quad \text{for } t \geq T_{cliff}$$

with T_{cliff} = 12 months and T_{vest} = 36 months, applied to the 13.5B EARTH Team & Founders allocation. No team supply circulates in year one; full vesting completes only at month 48 — aligning insiders with a multi-year build.

15.4 Emission Schedule (Validator & Staking Pool)

The 27.0B EARTH security pool is released under a decaying exponential, front-loading security incentives while approaching the cap asymptotically:

$$\text{Emitted}(t) = E_{pool} \times (1 - e^{-kt})$$

where E_{pool} = 27.0B EARTH and $k = \ln 3 / 5 \approx 0.22\ \text{yr}^{-1}$, calibrated so that exactly two-thirds of the pool is released within the first five years, tapering thereafter. Annual gross emission is therefore $E_{pool} \cdot k \cdot e^{-kt}$ — highest when the network most needs to attract stake, declining as fee revenue matures into the dominant validator income.

Fig. 16 — Vesting & Emission Schedule (Ten Years Post-GDE)

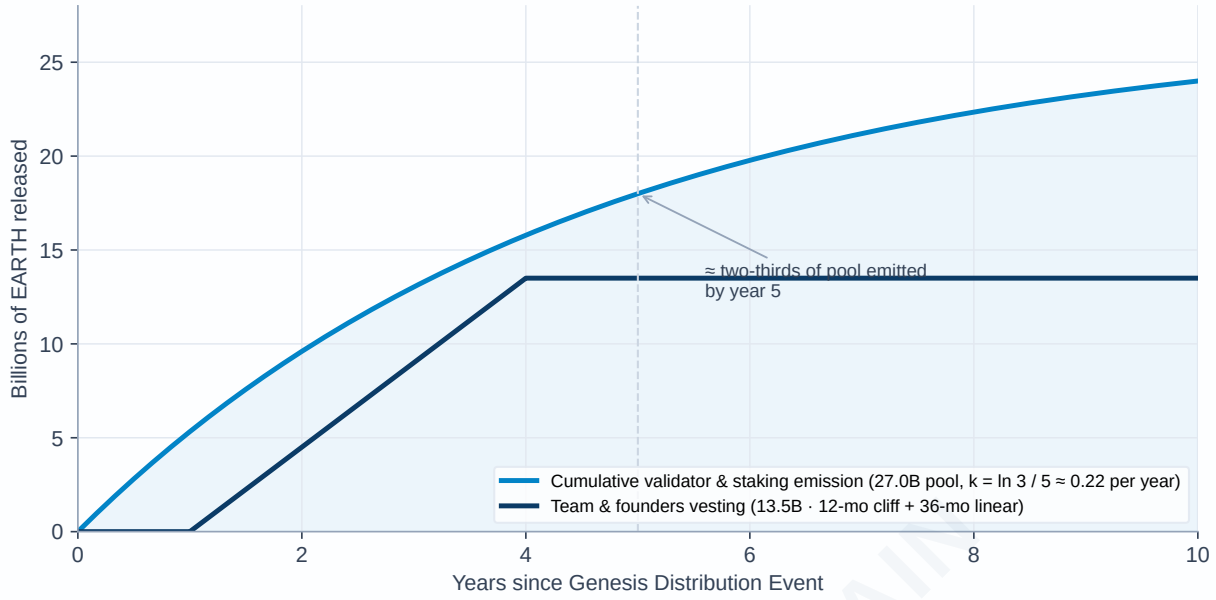


Fig. 16. Team vesting (cliff + linear) against cumulative validator/staking emission. The two largest time-locked supplies enter circulation on transparent, formula-defined schedules.

15.5 Staking Yield Model

$$\text{APY} = (\text{Annual Emission to Stakers} / \text{Total EARTH Staked}) \times 100$$

Because annual emission decays (§15.4) while the staked ratio is market-determined, yield is self-balancing: when participation is low, high APY attracts stake and restores security margin; as participation rises, APY compresses toward fee-driven equilibrium — a standard property of emission-funded staking systems, made predictable here by the closed-form emission curve.

Fig. 17 — Illustrative Staking APY vs. Share of Supply Staked

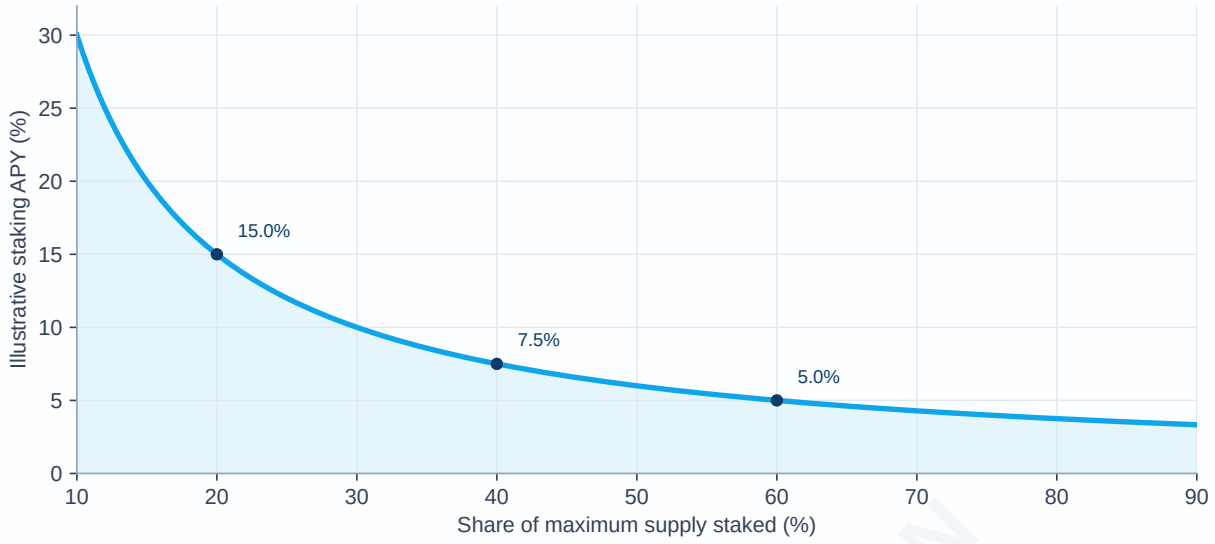


Fig. 17. Illustrative APY at a steady-state annual emission of 3% of maximum supply. Actual yield varies with the point on the emission curve, fee revenue, and staked ratio.

15.6 Deflationary Counterbalance (Fee Burn)

A governable share β of network base fees is burned rather than distributed, providing a deflationary counterweight to emission:

$$\text{Net Emission}_t = \text{Gross Emission}_t - (\beta \times \text{Total Gas Fees}_t)$$

$\beta \in [0, 1]$, set to 0.30 at genesis and tunable by EarthDAO. This lets governance steer the effective net issuance rate in response to real network usage — at sufficient transaction volume, EARTH becomes net-deflationary — without ever altering the fixed 90B maximum supply.

15.7 Economic Sustainability Summary

- **Security is pre-funded.** The largest allocation (30%) exists solely to pay for consensus security on a decade-plus schedule.
- **Insiders are patient by construction.** Team supply is zero in year one and fully vested only at month 48.
- **Usage tightens supply.** Fee burn couples monetary policy to real demand, not discretion.
- **Everything is governable except the cap.** Emission calibration, β, and program budgets sit with EarthDAO; the 90B ceiling does not.

16. Roadmap

TOWARD PUBLIC LAUNCH AND PROGRESSIVE DECENTRALIZATION · Q1–Q8

The roadmap spans eight quarters from the public-launch cycle, organized in four phases. Each phase carries explicit decentralization and security milestones alongside product delivery; the sequence reflects current priorities and is subject to revision by EarthDAO governance as the network matures.

Phase	Quarters	Milestones
Phase 1 — Foundation	Q1–Q2	Green Validator Network genesis (21 validators); PoSA testnet → mainnet hardening; core BaaS APIs (anchoring, RPC, events); Earth Wallets beta; block explorer (scan.earth.ooo); EarthDoc pilot deployments; third-party security audits of consensus and staking contracts.
Phase 2 — Ecosystem Expansion	Q3–Q4	EarthDAO governance launch (proposals, treasury, timelock); EBS reference implementations and audits (all nine standards); developer grants program; EarthSCM and Earth RWA pilots; SDK GA (TS, Python, Go, Java); wallet GA with account abstraction.
Phase 3 — Enterprise & ESG Scale-Up	Q5–Q6	EarthESG general availability with integrated carbon issuance, MRV pipeline, and registry integrations; enterprise validator onboarding; canonical bridge launch with rate limits and guardian process; active-set expansion proposal; permissioned-subnet architecture preview.
Phase 4 — Machine Economy	Q7–Q8	EarthAI agent identity, mandates, and payment channels GA; agent-transaction volume targets; cross-chain messaging GA; further active-set expansion and guardian-power sunset per decentralization schedule; ecosystem summit and university validator program.

> **Decentralization discipline.** Validator-set expansion, administrative-key transfer to EarthDAO, and guardian sunset are tracked as first-class roadmap items with the same visibility as product milestones.

17. Conclusion

Earth Blockchain unifies, in one Layer-1 network: a green, inclusive validator infrastructure; a formally specified Proof of Staked Authority consensus with deterministic finality and accountable economic security; a fully EVM-compatible execution core extended by enterprise-grade BaaS; nine native EBS standards spanning value, regulated assets, identity, and machine agency; open on-chain governance through EarthDAO; a compounding enterprise product suite — EarthDoc, EarthESG with integrated carbon infrastructure, EarthSCM, Earth RWA, and EarthAI; and the fixed-supply EARTH utility currency binding every layer into a single closed-loop economy.

The strategic wager is straightforward: the durable demand for blockchain infrastructure will come from institutions that must prove things — and, increasingly, from machines that must be provable. Earth Blockchain is engineered for exactly that demand: verifiable by default, sustainable in operation, operable by enterprises, governable in the open, and priced in a currency whose value is anchored to the network's real use. This whitepaper stands as the foundation document of that infrastructure — and of the long-term company being built upon it.

"Build trust. Move value. Protect the future."

References, Revision History & Legal Notice

SOURCES · REVISION HISTORY · CORPORATE INFORMATION · DISCLAIMER

[1] Earth Blockchain public platform — architecture, governance, product, and validator documentation (earth.ooo; explorer: scan.earth.ooo), retrieved July 2026.

[2] Internal protocol and tokenomics design parameters as specified for this whitepaper: 90,000,000,000 EARTH maximum supply; six-category allocation; 12-month cliff with 36-month linear vesting; decaying validator emission with k = ln 3 / 5; genesis governance and consensus parameters of §6 and §10.

[3] Ethereum Improvement Proposal corpus underlying EBS interface lineage: ERC-20, ERC-721, ERC-1155, ERC-1400, ERC-3643, ERC-4671, ERC-5192, ERC-3525, ERC-6551 (eips.ethereum.org), consulted for interface compatibility.

[4] Public design literature of comparable Layer-1 networks — including Ethereum, Solana, Aptos, Sui, VeChain, and Monad — consulted for whitepaper structure, consensus exposition, and economic-model presentation practices.

[5] Sustainability-disclosure frameworks referenced for structural alignment of EarthESG tooling: GHG Protocol Corporate Standard; EU CSRD/ESRS disclosure categories; SEBI BRSR (India).

Revision History

Version	Date	Summary of Changes
v1.0	July 2026	Initial public whitepaper: eight-layer architecture, PoSA consensus specification, enterprise product overview, and EARTH tokenomics.
v2.0	July 2026	Full editorial and technical revision: functional layer naming; expanded consensus, economic-security, interoperability, and governance specifications; Earth Blockchain Standards (EBS) section; EarthESG introduced as a core product with integrated carbon-credit infrastructure; EarthX removed; expanded product architectures and workflows; corrected emission constant (k = ln 3 / 5); unified visual identity.

Corporate Information

Earth Blockchain is developed and stewarded by **Earth Blockchain Corp.** (Wyoming, USA) together with **Alpha Blockchain Private Limited** (India; DPIIT-recognized), pending progressive transfer of protocol authority to EarthDAO as set out in §10 and §16.